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Confidence intervals for a ratio of binomial proportions based on direct and inverse sampling schemes

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Abstract

© 2016, Pleiades Publishing, Ltd.A general problem of the interval estimation for a ratio of two proportions p1/p2 according to data from two independent samples is considered. Each sample may be obtained in the framework of direct or inverse binomial sampling. Asymptotic confidence intervals are constructed in accordance with different types of sampling schemes with an application, where it is possible, of unbiased estimations of success probabilities and also their logarithms. Since methods of constructing confidence intervals in the situations when values for the both samples are obtained for identical sample schemes (for only direct or only inverse binomial sampling) are already developed and well known, the main purpose of this paper is the investigation of constructing confidence intervals in two cases that correspond to different sampling schemes (one is direct, another is inverse). In this situation it is possible to plan the sample size for the second sample according to the number of successes in the first sample. This, as it is shown by the results of statistical modeling, provides the intervals with confidence level which closer to the nominal value. Our goal is to show that the normal approximations (which are relatively simple) for estimates of p1/p2 and their logarithms are reliable for a construction of confidence intervals. The main criterion of our judgment is the closeness of the confidence coefficient to the nominal confidence level. It is proved theoretically and shown by statistically modeled data that the scheme of inverse binomial sampling with planning of the size in the second sample is preferred. Main probability characteristics of intervals corresponding to all possible combinations of sampling schemes are investigated by the Monte-Carlo method. Estimations of coverage probability, expectation and standard deviation of interval widths are collected in tables and some recommendations for an application of each of the intervals obtained are presented. Finally, a sufficient and complete review of the literature for the problem is also presented.

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Keywords

asymptotic confidence limits, Confidence limits, inverse binomial sampling, ratio of binomial proportions